Method for Extraction of Optical Properties from Diffuse Reflectance Spectra

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Technology description

Diffuse reflectance spectroscopy can be used to measure tissue absorption and scattering, which reflect the intrinsic physiological and structural properties of tissue respectively. This technique can potentially improve the accuracy of needle biopsy for diagnosing breast cancer. It could also be used for early diagnosis of cancers in other organ sites, minimizing the need for invasive surgical biopsies. However, current methods of extracting information about tissue from diffuse reflectance measurements are either computationally intensive or only valid in limited cases.UW-Madison researchers have developed a flexible and efficient Monte Carlo-based method for analyzing the results of diffuse reflectance spectroscopy and extracting absorption and scattering measurements from tissue. The method is valid for a wide range of optical properties, yet remains computationally feasible. It uses an iterative process that repeatedly models reflectance values from a set of estimated tissue optical parameters using a Monte Carlo model. It then calculates the error between the measured diffuse reflectance and the modeled reflectance values. Next, the tissue’ s scattering and absorption characteristics are calculated from the estimated optical parameters that result in minimum error. The concentrations of the absorbers in the tissue, including concentrations of oxygenated and deoxygenated hemoglobin, are easily extracted from the absorption coefficient and can be readily converted into two important physiological parameters: hemoglobin saturation and total hemoglobin content.
The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a flexible and efficient Monte Carlo-based method for analyzing the results of diffuse reflectance spectroscopy and extracting absorption and scattering measurements from tissue.

Application area

Determination of underlying physical properties of tissue that affect diffuse reflectance spectra, including hemoglobin concentration and saturation, beta-carotene concentration, and tissue scattering properties
Detecting cancer, including breast cancer

Advantages

Potential to provide a real-time, non-destructive, quantitative means of characterizing tissue pathology

May eliminate or reduce need for biopsies to confirm cancer diagnosis
Can be used for many applications in which information on hemoglobin saturation is needed
Absorption and scattering spectra may be constrained, reducing the number of free parameters
Valid for a wide range of optical properties, including high absorption

Institution

Wisconsin Alumni Research Foundation

Inventors

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